PAKISTAN

Participation and co-operation for development programmes

Science Education

by Dennis G. Chisman

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PAKISTAN

SCIENCE EDUCATION

by Dennis G. Chisman

Report prepared for the Government of the Islamic Republic of Pakistan by the United Nations Educational, Scientific and Cultural Organization (Unesco)

UNESCO
Acknowledgements

The interest in and support for my mission shown by the Minister for Education, the Secretary of Education and the various Education Advisers, particularly by Dr. M.H. Qazi and Dr. Mohammad Ilyas were greatly appreciated. As also was the day-to-day attention given to my programme by Mr. M.Y. Chohan, Senior Research Officer.

The administration support - office facilities, stenographer, messenger, driver - were also of the highest quality and much appreciated.
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acknowledgements</td>
<td>(i)</td>
</tr>
<tr>
<td>Introduction</td>
<td>1</td>
</tr>
<tr>
<td>Programme</td>
<td>1</td>
</tr>
<tr>
<td>The educational system in Pakistan</td>
<td>1</td>
</tr>
<tr>
<td>Current problems and plans</td>
<td>2</td>
</tr>
<tr>
<td>The teaching of science - the present position</td>
<td>2</td>
</tr>
<tr>
<td>Science education - the major problems</td>
<td>3</td>
</tr>
<tr>
<td>Science education - possible developments and recommendations</td>
<td>4</td>
</tr>
<tr>
<td>Science education development - specific proposals for immediate action</td>
<td>5</td>
</tr>
<tr>
<td>Problems in implementation of the proposals for developing science education</td>
<td>6</td>
</tr>
<tr>
<td>The role of multilateral aid agencies</td>
<td>6</td>
</tr>
</tbody>
</table>

**ANNEXES**

1. Itinerary of the mission  
2. Project proposal  

7  
9
INTRODUCTION

1. The mission described in the present report was carried out from 27 January to 18 February 1984 at the request of the Government of Pakistan, and was funded by Unesco under its Participation Programme for 1981-1983.

2. The terms of reference, as given in the Unesco contract, were wide-ranging and all-embracing as far as science education development in Pakistan was concerned. However, the specific terms of reference suggested by the Federal Ministry of Education on arrival in Islamabad were:

   (a) to advise on proposals to establish a National Institute for the Promotion of Science Education.

   (b) to prepare an "instrument of assessment" as a means of studying the status of Science education in Pakistan.

   (c) to write an appraisal report on the present syllabuses in science from grades 1 - 12.

   (d) to assist in developing a package of projects for the improvement of science education in Pakistan which might be presented to the Asian Development Bank as a basis for a loan agreement.

Programme

3. A programme of visits and discussions was drawn up by Dr. Mohammad Ilyas, Deputy Educational Adviser (Science and Technology) and Mr. Youusuf Chohan, Senior Research Officer, Federal Ministry of Education, which included visits to schools and colleges in the Islamabad area, both urban and rural, and to educational institutions in Lahore in the Province of Punjab. A detailed itinerary is given in Annex 1 to this report.

The educational system in Pakistan

4. Education in Pakistan is essentially a provincial responsibility. There are four provinces - Punjab, Sind, Baluchistan and North West Frontier - together with Azad, Jammu, Kashmir and the Federal districts administered directly from Islamabad.

5. The structure of the system follows the usual pattern of primary schools (grades 1 - 5), middle schools (grades 6 - 8), high schools (grades 9 - 10) and intermediate colleges (grades 11 - 12). The middle school level is usually attached either to the primary schools (giving a grade 1 - 8 pattern) or to high schools (giving 6 - 10 pattern). The intermediate college level is invariably part of a general college taking students up to grade 14, or B.Sc./B.A. level. There are a few high schools, however, which offer grade 11 - 12 work.

6. Public examinations, set by Provincial Education Boards for the provinces and by the Federal Board for Federal areas, are offered at grade 10 (matriculation or School Certificate) and grade 12 (Higher School Certificate or Intermediate of F.Sc. qualification) level. Examinations, in fact, are prescribed at many other levels as well, either as internal school assessments or by the public examination boards.

7. There are approximately 75,000 primary schools, 6,000 middle schools, 4,000 high schools and 200 intermediate colleges. Participation rate is relatively low being about 48 percent at the primary level, 26 percent at middle level and 16 percent at high school.
8. There is a vocational and technical education option from middle school level; this is only taken by a very small proportion of the students.

9. Further factual details about the education system, including the provisions at higher education and teacher education level, are given in the relevant chapter of the sixth Five-Year Plan, a copy of which will accompany this report.

Current problems and plans

10. The sixth Five-Year Plan presents a frank assessment of the problems in education facing Pakistan at the present time. They include:

(a) a literacy rate below 25 percent;

(b) a participation rate at primary level of only 48 percent;

(c) a share of government expenditure on education as a proportion of the GNP falling from 1.8 percent in 1977-1978 to 1.5 percent in 1982-1983.

11. Moreover, despite the agreed priority for primary education, accorded by previous Five-Year Plans, the broad base of the educational pyramid has not expanded satisfactorily whilst at the top end four new universities have been established in recent years with all the financial commitments that are entailed. Even now, plans are being discussed for the establishment of a Women's University and a high-powered, prestigious post-graduate Institute of Science and Technology.

12. The current sixth Five-Year Plan (1983-1988) is seriously trying to remedy these shortcomings by providing finance:

(a) to establish universal primary education at least at grade 1 level by the end of the five years;

(b) to increase the participation rate from 48 percent to 75 percent by 1987-1988. (Note: This implies an additional 5 million children to be provided with primary schooling) and to provide for a higher proportion of girls to receive primary education than hitherto;

(c) to establish additional mosque schools in villages which will provide basic education for grades 1 to 3 only;

(d) to launch a mass literacy programme, aimed at 15 million people, with greatest concentration on women in rural areas.

13. Whilst the main emphasis of the Plan is on primary education and adult literacy the intention of Government is also to secure the maximum feasible expansion of secondary education, especially in the rural areas, and to improve the quality of the teaching programmes at this level, particularly in science and mathematics.

The teaching of science - the present position

14. Science is a compulsory component of the curriculum in primary and middle schools (grades 1 to 8).

15. At the grade 9 level students have the option of choosing the science stream in which the separate subjects of biology, chemistry and physics
are taught, or of choosing arts and humanities subjects, in which course there is a general science component.

16. At the intermediate level science options will provide for various combinations of mathematics, biology, chemistry and physics as preparation for medical, engineering or science studies at B.Sc. or equivalent level.

17. There is little provision for activity work in science at the primary level, although primary education kits produced by the National Education Equipment Centre, (NEEC), with UNICEF support, have been supplied to 60,000 primary schools throughout the country. These kits contain about 100 items of equipment, including a large number designed for the primary science component of the curriculum. A teachers' guide has also been distributed with each kit.

18. Most of the teaching of science at middle school level is by theory lessons alone. Most middle schools (more than 94 percent in Punjab for example) do not have any facilities for teaching science through activity work - no science rooms or laboratories and virtually no equipment.

19. At the high-school level (grades 9 and 10) the proportion choosing the science option is only about 35 percent. This is higher than hitherto but is still very low, and is much lower than the Government would wish in its efforts to provide a stronger scientific and technological base for the economic development of the country. The low proportion is a reflection of the lack of physical facilities for practical work in the majority of high schools, (Note: More than 70 percent of high schools in Punjab for example have no laboratory facilities) and the unavailability of suitably trained science teachers. (Note: Many experienced and qualified science teachers have migrated to Middle East and African countries.)

20. For those who choose science as an option at grades 9 and 10 levels there is a practical test in the Matriculation examination. This is, of course, quite simple, and is essentially a repetition of one or more of the experiments or demonstrations carefully prescribed in the official syllabus.

21. Likewise, at the intermediate level there are practical requirements based very largely on verification experiments in physics, repetitions of titrations and analysis in chemistry, and repetitions of dissection (of the frog usually) and of observations of slides through a microscope, in biology.

22. Although education is a provincial responsibility the curricula are prescribed by the Federal Government, co-ordinated by the Curriculum Wing of the Federal Ministry in conjunction with Provincial Curriculum Centres. Textbooks are also a provincial responsibility (each Province has a Textbook Board) but again there are national norms laid down by the Federal Government, and all textbooks have to receive the approval of the Curriculum Wing.

23. The syllabuses currently in use in science throughout the country are based on curriculum development projects of the early 1970s and all are dated 1976 or earlier. These syllabuses have been analysed, and the analysis or appraisal is available separately.

Science education - the major problems

24. The Government in its sixth Five-Year Plan and the Ministry of Education in its Action Plan for Educational Development (1983-1988) express awareness of the problems and shortcomings of the teaching of science in schools and have resolved to overcome some of the problems, as a matter of priority, within the next few years.
25. The major problems, of which the Government is fully aware, are:

(a) inadequate facilities for teaching science - e.g. lack of physical facilities for teaching science in more than 90 percent of middle school classes;

(b) poorly trained and poorly motivated teachers of science, and in some sectors inadequate numbers of trained teachers;

(c) outdated syllabuses and textbooks, and methodologies of teaching based on dogma and rote learning;

(d) inadequate infrastructure to bring about co-ordinated action to improve the situation owing to the fragmented nature of the institutions involved - curriculum wings, textbooks boards, education boards, equipment centre, some at provincial level only, and others at federal and provincial level; and an inadequate infrastructure to monitor the situation, either provincially or nationally, or to promote research into methodologies and content of science education relevant to Pakistan;

(e) general shortage of suitably qualified and experience leaders in science education at both federal and provincial level.

26. The greatest problem, however, is how to overcome these acknowledged deficiencies in the most cost-effective way and within the resources available or likely to be available.

Science education - possible developments and recommendations

27. The Action Plan for Educational Development puts forward a number of projects and proposals for improving the teaching of science at all levels, including the establishment of a National Institute for the Promotion of Science Education. This proposed Institute would, in addition to a co-ordinating role, undertake a number of activities designed to stimulate the improvement of science education throughout the country from grade 1 to 12.

28. Unfortunately, improvements in education generally, and in science education in particular, through a multi-pronged programme, cannot all succeed at the same time. Even in the most sophisticated and centrally-controlled system, and even with the greatest of financial resources, educational development is a time-consuming process - simply because education is concerned with people (students, teachers, administrators, parents and the public generally) and people's attitudes and training, and not just about the physical improvement of schools and colleges and the provision of books, equipment and teaching aids.

29. Thus, hard decisions have to be made about priorities and timescales within the financial resources available and within the realistic capabilities and numbers of the staff available, especially at the managerial and top professional level.

30. With these considerations in mind, and as a result of much discussion with officers of the Federal and Punjab Provincial Governments, the following papers were prepared and presented to the Federal Ministry of Education for consideration:

(a) A revised draft of sections of the Annexes of the PC.I entitled "Institute for the Promotion of Science Education".
(b) A separate draft for the proposal to establish five Regional Centres for the Promotion of Science Education'.

(c) A statement about an in-service training programme - and the likely cost implications - to dovetail into the programme of curriculum development and the training of master teachers to be co-ordinated or conducted by the National Institute for the Promotion of Science Education.

(d) Comments on possible components for a major programme for the improvement of science education at grades 6-12 level throughout Pakistan, including the provision of new laboratories and upgraded facilities in middle schools, high-schools and intermediate colleges. These components might form the basis of a loan agreement with the Asian Development Bank.

(e) An appraisal of the present science education curricula at the various levels in schools and colleges.

(f) A first draft of a survey, covering factual information about science education and methodology of teaching science, which might form the basis of a nationwide assessment of the present situation of science education in the schools and colleges of Pakistan.

Note: Copies of these papers are available separately.

31. These papers have been compiled in the belief that priorities might be allocated in descending order to (a) middle schools (b) high-schools and (c) intermediate colleges, but with the understanding that overall priority for education as a whole should continue to be given to primary education, at which level all subjects, including science, should be regarded as inter-related whole and should, therefore, be the concern of the primary education specialists in the Federal Curriculum Wing and Provincial Curriculum Centres suitably linked to the Primary Education Project.

32. The highest priority should be given to curriculum development at the respective levels mentioned above, with the consequent retraining required and with the provision of appropriate facilities for teaching science, including equipment and teaching aids.

Science education development - specific proposals for immediate action

33. To develop the ideas contained in the papers referred to in paragraph 30 above, and to turn ideas into action, the following specific proposals were made to the Federal Ministry of Education for consideration within the next six months:

(a) A major national science education curriculum seminar should be held to bring together the various national and provincial curriculum subject committees in science and other interested organizations and individuals in order to develop an agreed outline - aims, objectives, principal components - of science education for the 1980s.

(b) A national survey of science education be conducted, through provincial Ministries of Education, to provide a base-line for assessing needs. Such a survey might need to be preceded by consultations and professional visits by Federal Ministry of Education officers.
34. At the same time it is assumed that negotiations with the Asian Development Bank - on the basis of Annex 2 - will take place so that, if successful, the building of the proposed Institute for the Promotion of Science Education and the provision of upgraded facilities in schools and colleges can begin on a phased programme from, say, end of 1984 or 1985 and the ensuing five years.

Problems in implementation of the proposals for developing science education

35. The development of new syllabuses, the provision of facilities, the re-training of teachers, and the creation of a new institute do not necessarily guarantee that changes will actually take place in the schools. But at least they should be a move in the right direction.

36. There will be many problems to be considered. Among these the most pressing would seem to be:

(a) the availability of a minimum core of really well-trained Pakistani science educators, whose training and experience embrace a full appreciation of modern aspects of science education.

(b) the willingness, or otherwise of provincial Ministries of Education to collaborate with the new schemes.

(c) the adequate supervision and monitoring of the developments at the grassroots level.

The role of multilateral aid agencies

37. If the appropriate requests are forthcoming from the Government of Pakistan there are a number of crucial contributions to be made by multilateral aid agencies towards the development of science education in Pakistan - both in school and out-of-school. These would include:

(a) the provision of a team of experts over a five-year period to assist in the development of the proposed Institute for the Promotion of Science Education, specifically in the fields of curriculum development, in-service training, popularization of science, research and testing.

(b) the provision of consultants to (i) assist in the proposed national curriculum seminar and (ii) assist in the preparation and analysis of a science education study to assess the present state of science teaching in the country.

(c) the provision of fellowships in science education as part of the staff development programme of the Institute for the Promotion of Science Education.

Footnote:

38. The tour by the Secretary of Education, Joint Educational Adviser and the Director, Science Museum, arranged by Unesco, to visit science education centres in Thailand, Korea, Philippines, Singapore, Malaysia and RECSAM is well-timed - the officers left on 14 February - and could well be most influential in helping the Ministry to develop further its plans for an Institute for the Promotion of Science Education and for extension of the work of the Science Museum, Lahore.
ANNEX 1

ITINERARY OF THE MISSION

27 January 1984  Arrival in Pakistan.

28 " "  Discussions in Ministry of Education, Islamabad.
- Mr. Saeed Ahmad Qureshi, Secretary Education.
- Dr. M.H. Qazi, formerly JEA (Science and Technology)
  now Professor of Biology, University of Quaidi-e-Azam,
  Islamabad.
- Dr. Mohammad Ilyas, Deputy Educational Adviser
  (Science and Technology).
- Mr. Yousuf Chohan, Senior Research Officer.

29 " "  Curriculum Wing, Ministry of Education
- Mr. Abdullah Khadim Hussain, JEA (Curriculum)
- Mr. Ikram Ellahi Sheikh, Deputy Educational Adviser (Curriculum).

30 " "  College of Education, Islamabad.
- Principal Mrs. Z.Q. Farooqui.

31 " "  Academy of Educational Planning and Management, Islamabad.
- Director General, Dr. Tahir Hussain.

1 February "  Educational Planning Department, Ministry of Education,
  Islamabad.
- Mr. Rafiq Ahmad, JEA (Planning)

National Institute of Psychology.
- Director Dr. Z.A.Ansari.

2 " "  Primary Education Project.
- Director Prof. Laeeq Ahmad Khan
- Unesco Adviser: Dr. Roy Davis.

3 " "  Taxila Museum and archeological sites.

- Mr. Karamat Ali Khan, Additional Secretary

National Educational Equipment Centre, Lahore.
- Director: Mr. Mohammad Aslam Popalzai

Science Museum, Lahore.

5 " "  Institute for Educational Research, University of Punjab, Lahore.
- Director: Dr. Munir Chughtai.

Education Extension Centre, Lahore.
- Director, Mrs. S.Z. Ali.

Curriculum Research & Development Centre, Lahore.
- Director Prof. Mohammad Saeed Ahmad.

College of Education for Women, Lahore.
- Principal: Mrs. S.P. Mirza.
<table>
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<tr>
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<td>6 February 1984</td>
<td>Discussions: Ministry of Education, Islamabad</td>
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<td>7</td>
<td>Islamabad Model School for Girls. Middle School for Girls, Islamabad.</td>
</tr>
<tr>
<td>9</td>
<td>Islamabad Model School for Boys. F.G. College for Men, Islamabad.</td>
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<td>10</td>
<td>Rawalpindi Ayub Park.</td>
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<td>11</td>
<td>Minister for Education - Discussions</td>
</tr>
<tr>
<td>12</td>
<td>Dr. Abdul Hameed Qureshi, Deputy Educational Adviser (Technical).</td>
</tr>
<tr>
<td>13</td>
<td>University Grants Commission. Academy of Higher Education.</td>
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<td>15</td>
<td>School visits in Islamabad area.</td>
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<td>16</td>
<td>Discussions, Ministry of Education.</td>
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<td>Free for report writers.</td>
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</table>
ANNEX 2

PROJECT PROPOSAL

DEVELOPMENT OF SCIENCE EDUCATION IN PAKISTAN

1. Objectives

In accordance with the sixth Five-Year Plan and the Action Plan of the Ministry of Education, this project is designed to improve the overall quality of science education at grades 6 to 12 in educational institutes in Pakistan, to provide the necessary infrastructure to initiate and sustain this development and to provide an in-service training programme for science teachers commensurate with the needs of the project.

2. Components of the project

A. To establish a national institute for the promotion of science education.

B. To upgrade selected educational institutions at provincial level in order to provide five Regional Centres for Science Education.

C. To provide a new programme at provincial and local level of in-service training for science teachers and lecturers with the necessary training of master teachers and tutors.

D. To provide Science laboratories for 3,000 middle schools (grades 6-8).

E. To provide 500 high schools (grades 9-10) with multipurpose science laboratories.

F. To develop and produce 10,000 science kits for middle school level classes (grades 6-8).

G. To develop and produce science equipment for high schools (grades 9-10) deemed to have no apparatus or inadequate supply of apparatus (estimated 3,000).

H. Provision of improved facilities, including equipment, for the teaching of science at intermediate college level (grades 11-12).

I. To improve the facilities for teaching science at 50 teacher-training colleges and institutes.

J. To strengthen the capacity and capability of the National Education Equipment Centre for the design, production and storage of apparatus for schools.
### 3. Cost estimates

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<th>Description</th>
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<td>A. Institute for the Promotion of Science Education</td>
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<tr>
<td>B. Provincial Science Education Centres</td>
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<tr>
<td>C. In-service teacher training</td>
<td>46.00</td>
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<tr>
<td>D. Middle school science laboratories (3,000)</td>
<td>510.00</td>
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<tr>
<td>E. High school laboratories (500)</td>
<td>175.00</td>
</tr>
<tr>
<td>F. Science kits (10,000) for middle schools</td>
<td>100.00</td>
</tr>
<tr>
<td>G. Additional science apparatus for high schools (2,500)</td>
<td>25.00</td>
</tr>
<tr>
<td>H. Additional science equipment for intermediate colleges</td>
<td>30.00</td>
</tr>
<tr>
<td>I. Improved facilities for teacher colleges (50)</td>
<td>10.00</td>
</tr>
<tr>
<td>J. Strengthening of Education Equipment Centre</td>
<td>10.00</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>957.00</strong></td>
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Approximately = Rs. 1,000 million

= $70 million